**Classification of closed surfaces:** *Any closed connected surface $S$ is equivalent to exactly one of the surfaces $M_g$ ($g = 0, 1, 2, \ldots$; a sphere with $g$ handles) or $N_h$ ($h = 1, 2, 3, \ldots$; a sphere with $h$ crosscaps). The surfaces can be identified by their orientability and Euler characteristic: the $M_g$ are orientable with $\chi(M_g) = 2 - 2g$, whereas the $N_h$ are non-orientable with $\chi(N_h) = 2 - h$.*

**Definition:** The **genus** $g$ of a closed surface $S$ is defined by $g(S) = 1 - \frac{1}{2}\chi(S)$ for an orientable surface and by $g(S) = 2 - \chi(S)$ for a non-orientable one.

**Classification of surfaces with boundary:** *Any connected surface $S$ with $n \geq 0$ boundary components is equivalent to exactly one of the surfaces $M_g^n$ ($g = 0, 1, 2, \ldots$; an $n$-punctured sphere with $g$ handles) or $N_h^n$ ($h = 1, 2, 3, \ldots$; an $n$-punctured sphere with $h$ crosscaps). The surfaces can be identified by their number of boundary components, orientability and Euler characteristic: the $M_g^n$ are orientable with $\chi(M_g^n) = 2 - 2g - n$, whereas the $N_h^n$ are non-orientable with $\chi(N_h^n) = 2 - h - n$.*

For the proofs and further details see e.g. Robert's Notes, section 6.8.